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BERMEX '81 - TECHNICAL SUPPORT FIELD SERVICE IN SUPPORT OF VEDA--ETC(U)
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BERMEX 81 - TECHNICAL SUPPORT

Field Service in support of VEDABS

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2 November 1981

Final Report for Period 26 August 1981 - 20 September 1981

Prepared for

Scientific Officer
Ocean Programs Management Office
Surveillance Environmental Acoustic Support Project (SEAS)
Naval Ocean Research & Development Activity (NORDA)
NSTL Station, MS 39522

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: N00014-81-C-0777	2. GOVT ACCESSION NO.: AD-A107 666
	3. RECIPIENT'S CATALOG NUMBER:
4. TITLE (and Subtitle): BERMEX '81 - TECHNICAL SUPPORT Field Service in support of VEDABS	5. TYPE OF REPORT & PERIOD COVERED: Final Report for Period 26 August 1981- 20 Sept 1981
	6. PERFORMING ORG. REPORT NUMBER:
7. AUTHOR(s): James A. Carnell	8. CONTRACT OR GRANT NUMBER(s): N00014-81-C-0777
9. PERFORMING ORGANIZATION NAME AND ADDRESS: C & M Systems, Inc. Saybrook Industrial Park Old Saybrook, CT 06475	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS:
11. CONTROLLING OFFICE NAME AND ADDRESS: Surveillance Environmental Acoustic Support Naval Ocean Research & Development Activity NSTL Station, MS 39522	12. REPORT DATE: 2 November 1981 13. NUMBER OF PAGES:
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office):	15. SECURITY CLASS. (of this report): Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:
16. DISTRIBUTION STATEMENT (of this Report): Unlimited	
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report):	
18. SUPPLEMENTARY NOTES:	
19. KEY WORDS (Continue on reverse side if necessary and identify by block number):	
20. ABSTRACT (Continue on reverse side if necessary and identify by block number): A chronology of C & M Systems, Inc.'s technical participation in at-sea and in-port operations in connection with engineering tests of the Versatile Experimental Data Acquisition Buoy System.	

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Introduction:

Government Contract No. N00014-81-C-0777 was issued to C & M Systems, Inc. to "provide two (2) senior technical representatives for in-port and at-sea support services aboard a U.S. Government vessel in, and around Bermuda", in connection with NORDA's BERMEX '81 engineering sea tests. The purpose for this technical service was to assist in the pre-launch preparations and at-sea deployment and recovery of VEDABS equipment and to assess various components, systems and techniques toward future improvements.

The technical service was performed over the period 26 August 1981 through 20 September 1981 for a total effort of 51 man days.

Report Details

The VEDABS pre-launch preparations were divided into; 1) the electronic systems being assembled and tested at NUSC's Tudor Hill Laboratory and 2) the acoustic array(s) and instrumentation pressure vessels' (IPV) assembly and test being performed in a warehouse at the U.S. Naval Station annex.

The work at Tudor Hill by C & M personnel consisted mainly of checking out the electronics with primary emphasis being placed on sequencing and timing functions. The Time Display Boards and the Time Code Generators caused some problems which were subsequently corrected resulting in predicted performance during calibration testing and actual systems' data gathering missions. A chronological report of these services is contained in N.R. Messier's trip report of 8 September 1981 in the appendix hereto.

The effort at the Naval Annex consisted primarily of assembling the array cables. The cables were received on reels from the manufacturer and had to be laid out and marked in 100 foot (30.5m) increments. Four, 1000 meter cables were assembled into two (2) arrays of four (4) hydrophones each, spaced at 500 meters.

One array was to extend above the IPV while the second array extended below the IPV to the anchor release(s) and anchor. Both arrays connect to the IPV via a single, multi-pin connector at launch.

One section of the array was submerged overnight in sea water at a pier at the annex to test electrical connections and hydrophones' performance. The array cable, when retrieved from the bottom had snagged a long discarded, large diameter wire rope that fortunately caused no damage, but the potential risks precluded further tests of this type. One of the IPV/Flotation assemblies was moved into the air conditioned space in the warehouse and prepared to receive the battery and electronics chassis to complete the final checkout of the arrays integrated into the recording system.

On 30 August 1981 the battery and electronics chassis were moved from Tudor Hill and installed in the IPV in the annex. The electronics were exercised and a test recording of system calibration levels was completed. The electronics was removed on 31 August and returned to Tudor Hill for installation of the mission tape and performance of header calibrations. The electronics was returned to the annex and on 1 September, it was installed in the IPV in preparation for moving to the USNS Bartlett.

Check out of the system uncovered a number of malfunctions in the timing circuits. The specific nature of the problems and fixes were lost in

the multiple replacements of TCG's and the Initial Start boards. One broken solder joint on a connector lead on the TCG, causing a troublesome, intermittant fault, was repaired and the system was programmed for the mission.

On 2 September the IPV and array were moved to the USNS Bartlett. The ship departed for the op area and, due to weather and mechanical breakdown, returned to the Naval Annex 4 September.

The second VEDABS (IIB) was moved into the air conditioned space and prepared for the second suite of electronics.

Weather and engine problems kept the Bartlett in port with the 1st VEDABS (IIA) aboards.

On 9 September plans were made to ready VEDABS IIB to replace IIA whose timing circuits had been running since 1 September. The electronics chassis for VEDABS IIB was installed and checked out. The IPV was closed on 10 September and left in the warehouse.

A check of VEDABS IIA aboard Bartlett indicated normal performance and deployment of this system appeared prudent. Bartlett departed for the op area.

On the night of 10 September, C & M personnel assisted in the launching of the wind speed buoy under the direction of Mr. Peter Skip of Daubin Systems.

11 September VEDABS IIA was moved from its transport position to its launch position on the fantail, under the "U" frame and the system was rigged for deployment. At 1407 hrs the 1st float was over the side followed in succession by the upper array (deployed from a box), the IPV, the lower array, acoustic release(s) and the anchor at 1537 hrs. The deployment was without incident.

12 September the CODDAS Buoy was launched

13 September the wind buoy which had drifted off station was triggered to release its anchor. The bitter end was retrieved and a new anchor was installed and the buoy was re-anchored.

The VEDABS anchor was released and the upper floats were acquired visually. Recovery of the array commenced with no visual or R.F. indication that the IPV had surfaced. At some point after the 1st 1000 meters of array had been recovered the IPV was observed on the surface. The balance of the recovery was uneventful. All indications were that the system had performed as predicted throughout the entire mission.

The CODDAS was retrieved and aboard by 0200 hrs. 14 September. A pair of glass flotation spheres which support the radio direction beacon and flashing light were destroyed by implosion of one or both, (one was totally gone) causing the sympathetic destruction of both the beacon and light.

The Bartlett returned to the Dockyard, Bermuda on 14 September. The IPV was opened on deck and the electronics chassis was removed for immediate transfer to Tudor Hill for tape analysis.

15 September - C & M's participation was reduced to one mechanical technician.

VEDABS IIB was transferred to Bartlett and IIA was returned to the warehouse at the Naval Annex.

The array was removed from the cable reel and replaced in the deployment box for a normal, "anchor last" deployment.

The array was tested and connections broken during previous deployment were repaired. The IPV assembly was rigged with auxiliary flotation (6 football floats) to accelerate the IPV's return to the surface.

Bartlett sailed on 17 September and was on station in the op area at 1600. VEDABS IIB and CODDAS were launched without incident.

On 19 September CODDAS and VEDABS were recovered. Numerous hydrophone leads were separated at the connector. The ends showed evidence of electrolytic action and the absence of power at the connector leads indicated separation in the water with attendant blown fuses. (Subsequent tape examination determined that four breaks occurred during launch).

Bartlett returned to Bermuda and C & M Systems, Inc.'s direct participation in BERMEX '81 operations terminated on 20 September.

Conclusions and Recommendations

General

The fact that two data gathering missions were successfully conducted with VEDABS in the face of adversity is testimony to the systems' capability and a credit to the tenacious teamwork of the participants. The weather (no less than four hurricanes with which to contend) and engine problems on the ship not withstanding, the engineering tests required field assembly of systems and components, which by their complexity, would almost certainly have, under less fortunate circumstances, invalidated the tests or resulted in outright failure. The success of both deployments however seem, in this case, to have justified the means.

The program necessitated the assembly of hydrophone arrays of new design from brand new cable delivered directly from the manufacturer. The assembly area of the arrays was the staging area for pre-deployment assembly of the IPV and system check out. This staging area (annex warehouse) was remote from the electronics assembly and test area (Tudor Hill) requiring truck transport of the electronics chassis back and forth for the various calibrations and tests. Finally, the sealed IPV had to be transported to the ship (a third area) where opening of the IPV for further adjustments was prohibitive

The recommendations in this regard are several.
The first is obvious and is not meant to be a criticism of the BERMEX '81 operation but applies to future planning:

1) Allow sufficient time and/or manpower to complete assembly and testing of sub-systems in the laboratories rather than in the field.

2) Provide ample space in a single location for pre-deployment electronic checks, system's calibration, battery charging, mission tape loading and IPV sealing, and 3) provide laboratory space or a portable enclosure aboard ship to accommodate the IPV to facilitate multiple deployment on a given mission or just the ability to maintain the system at sea.

The third recommendation would have been difficult to satisfy on Bartlett under the given conditions. The "Clam Shell" nature of VEDABS IIA & IIB prevent it from being brought in the dry lab and available deck space precluded a van. Measurements, however, were taken and a determination made that the dry lab door and internal space would accommodate the horizontal VEDABS.

Electronics

The VEDABS II electronics package consists of a number of discrete elements and components some of which are used intact while others are modified for the intended function. This concept, while expediant, results in interface problems that often results in short term assignment of blame and quick fixes while postponing or neglecting long term solutions.

The electronics required assembly and reassembly and exchange and interchange of parts and components all of which necessitated test and check out and all of which were done under a aura of urgency, namely a ship departure. These are not unusual conditions for a fully operational system but they add manifold risks to the performance of an engineering test.

Now that the tests are concluded and the system has demonstrated its capability, the following recommendations are made:

1. Re-examine each of the sub-systems' functional requirements and redesign, where necessary, those systems that don't fully correspond to the whole system. Specifically, the time code generator is the heart of the electronics system and its serviceability is diminished in its present configuration. It has functions that are unused in VEDABS which could be eliminated. It should be redesigned to consist of two or three PC boards comparable to all other system boards. Pre-set functions could be added to the time display panel.

2. Documentation should be prepared covering this new, composite electronics chassis and battery package. It should include: (a) detail schmatics and wiring lists, (b) detail instructions on programming the system with proper reference to component manufacturers' instruction manuals, (c) battery charging and testing procedures, (d) a detailed checklist covering initial preparation through final checks just prior to launch (e) installation procedures (battery & IPV bulkhead connection)

3. A full compliment of spare PC boards and discrete components should be maintained for each VEDABS.

Mechanical

As previously mentioned the launch and retrieval sequences went off without significant event. The arrangement of arrays above and below the IPV necessitated the mechanical securing of each half of the array to the IPV, the connection of each individual lead of both halves of the array to a single multi-pin connector, and the installation of chaffing gear and suitable strain reliefs. It is strongly recommended

that each array have its own connector with strain relief and chaffing gear which has been laboratory installed and tested.

In the launch and retrieval sequence it was necessary to "stop-off" the array. Where possible this was done by installing a braided Kevlar, "chinese finger" which is undamaging to the cable. During retrieval, however, the IPV was so close to the stern, a regular rope stopper was employed to permit detachment of the lower array from the IPV and its re-attachment to the end of the upper array to continue hauling in on the cable reel. This type of stopper puts a severe knuckle in the array cable and is not all that positive. It is recommended that arrays in the future have permanent, stopper eyes attached at strategic locations.

It is also recommended that the IPV structure have "U" pads or eye bolts at several locations to accommodate tag lines and permit their free running during launch. Further, the IPV's storage or mounting cradle should be redesigned to facilitate its use when moving the IPV on deck. It should be made fast to the IPV until ready for launch. Provisions should be made for attachment of additional blocks of Syntactic foam when heavier arrays are contemplated.

TRIP REPORT Appendix A

DATE: 8 September 1981

TO: File

FROM: Nelson R. Messier

SUBJECT: Trip report, operational participation of N.R. Messier in Bermex 81

Wednesday, August 26

Arrived in Bermuda and reported to Tudor Hills Laboratory. Inspected facility and visited U.S. Naval Base to help unload equipment that was shipped to Bermuda for this operation.

Thursday, August 27

Started moving VEDABS equipment from the Naval Base warehouse, to the laboratory at Tudor Hill for initial checkout of systems. The chassis electronics for three VEDABS systems were located in the assigned area, and system checkout for the first launch was started with NORDA and C & M personnel present.

Friday, August 28

Began checkout of the Time Code Generator for the second VEDABS. Time display board had a damaged pin and board 3404 had a bad gate package. When these were repaired the timing functions and system sequencing were verified several times.

VEDABS I was prepared for an all night recording test to observe calibration levels and individual recorder channel gains.

Changed battery packs from VEDABS I to VEDABS II to assure ample power for an all night recording. When VEDABS II was connected to the battery packs that had been connected to VEDABS I, two wires in

the jumper cable from the battery to the chassis melted due to excessive current. There was a jumper on the terminal strip in the chassis that shorted these leads. The battery pack that caused the short had an extra voltage section that is needed for the Geo Tech recorder. The jumper was removed in the chassis and the burned leads were replaced.

Saturday, August 29

The tape was removed from the recorder in VEDABS I and reviewed by technical representatives from Bell & Howell and the University of Texas. The hydrophone amplifiers were not on the proper tracks and the problem was resolved that the recorder manual was incorrect. The Bell & Howell representative gave the correct wiring data and the pins in the external recorder connector were changed to make the channels agree with the wiring data.

It was found that when the power switch on the time display board was closed or opened the voltage surge in the line could cause system malfunctions. A 100 microfarad capacitor was added to the power line on the display board 27001 on both units to smooth these surges.

Some gain measurements were taken at several points in the amplifier cards for record purposes.

500 HZ Input		20 HZ Input	
TP1	-99.5 db	TP1	-95.6 db
Pin 2 Eltec	-98.1	Pin 2 Eltec	-96.2
Pin 6	-79.5	Pin 6	-77.2
Pin 7 pre-white	-47.2	Pin 7 pre-white	-71.9
TP2 Gain set 2	-35.0	Pin 2 gain set(2)	-54.8
TP 3	-35.0	TP 3	-b5.6

Sunday, August 30

Assembled printed circuit boards for VEDABS II and ran repeated tests of control circuits. A problem became apparent in the design of the new board 3404 for calibration timing. The problem was chip 1702 on board 3404 was not reset when power is applied and could cause incorrect calibration relay switching on the amplifier cards. To eliminate this problem, two diodes were added on the board that will assure a reset on 1702 and 7101 until the initial start has occurred. This mod. was added to the control board in VEDABS II and the spare board.

Monday, August 31

VEDABS I was tested in the pressure housing at the Naval base warehouse and a test recording of system calibration levels was completed.

The array cable that had been assembled for this operation was prepared for transportation to USNS Bartlett.

Tuesday, September 1

N.R. Messier returned to Connecticut - J. Carnell and G. Chartress remained in Bermuda.